AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.2.1 CURRENT, POTENTIAL DIFFERENCE AND RESISTANCE (PACK 3)

SCORE	PERCENTAGE
/174	%

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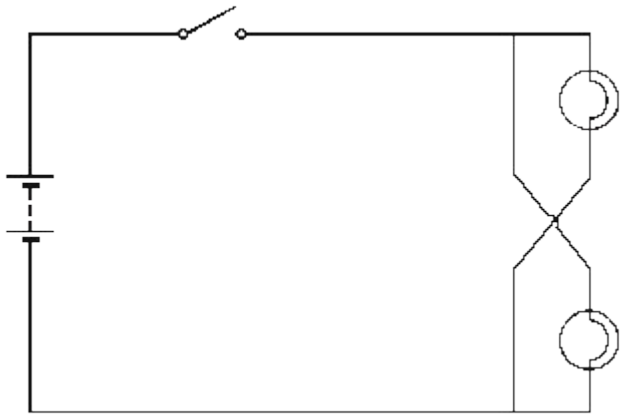
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Q1.

The circuit diagram below shows a circuit used to supply electrical energy to the two headlights of a car.



The current through the filament of one car headlight is 3.0 A. The potential difference across each of the two headlights is 12 V.

(a) Suggest a suitable fuse for the circuit. _____

(1)

(b) Calculate the resistance of the headlight filament when in use.

_____

_____

_____

_____

Answer _____ W

(2)

(c) Calculate the power supplied to the two headlights of the car.

_____

_____

_____

Answer _____ W

(2)

(d) The fully charged car battery can deliver 72 kJ of energy at 12 V. How long can the battery keep the headlights fully on?

_____

_____

_____

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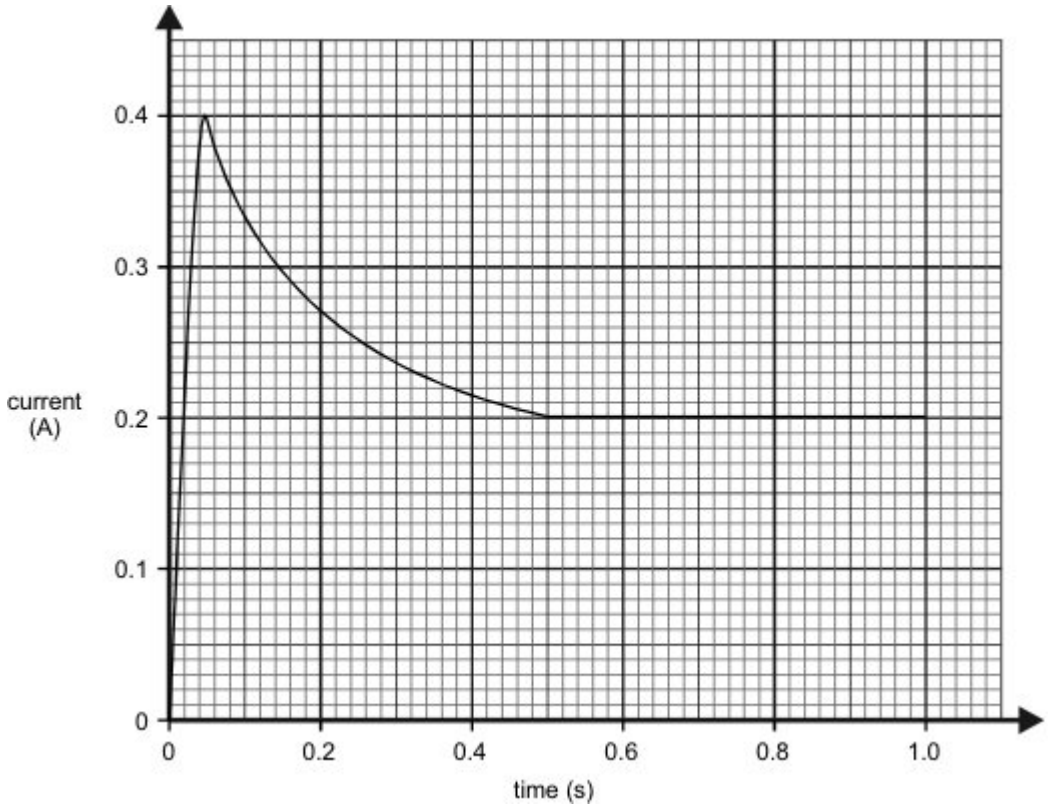
Answer _____ s

(2)

(Total 7 marks)

Q2.

When a mains lamp is switched on it takes 0.5 seconds for the filament to reach its normal operating temperature. The way in which the current changes during the first second after switching on is shown in the sketch graph below. Mains voltage is 240 V.



(a) Calculate the resistance of the filament whilst the lamp is drawing the **maximum** current.

_____

_____

_____

(3)

(b) Describe how the resistance of the lamp changes after the current has reached its maximum value.

_____

_____

(2)

(c) Calculate the **maximum** power taken by the lamp.

_____

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_____

_____

(2)

(d) Calculate the power of the lamp in normal use.

_____

_____

_____

(2)

(e) Calculate the energy used by the lamp in six hours of normal use.

_____

_____

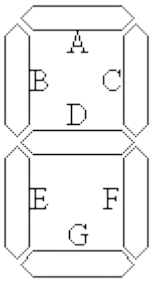
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(3)

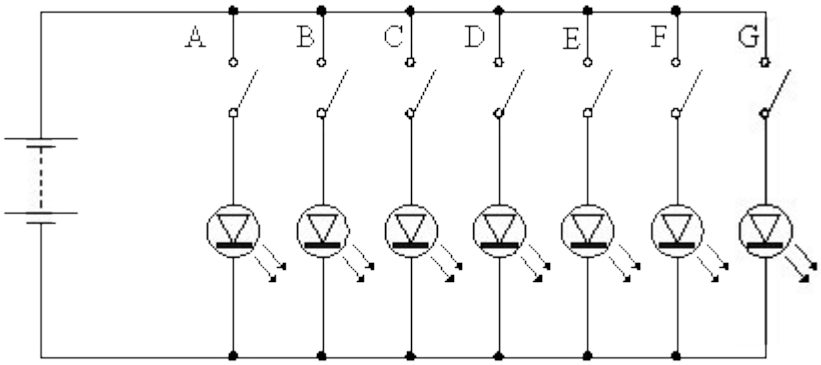
(Total 12 marks)

Q3.

Some electronic calculators use light emitting diodes (LEDs) to display numbers. Each number in a display consists of up to seven LEDs. The LEDs are arranged as shown in the diagram below. The different numbers are formed by switching different LEDs on at the same time. The LEDs are labelled A to G.



A simplified circuit to provide power to the LEDs is shown below.



(a) Explain why each LED has its own switch.

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_____

_____

(2)

(b) What number is displayed when all switches except E are closed?

_____

(1)

(c) Which switches would be open if the number 3 is to be displayed?

_____

(1)

(d) Which of the numbers 0 to 9 draws least current from the battery? Explain your answer.

Number _____

Explanation _____

_____

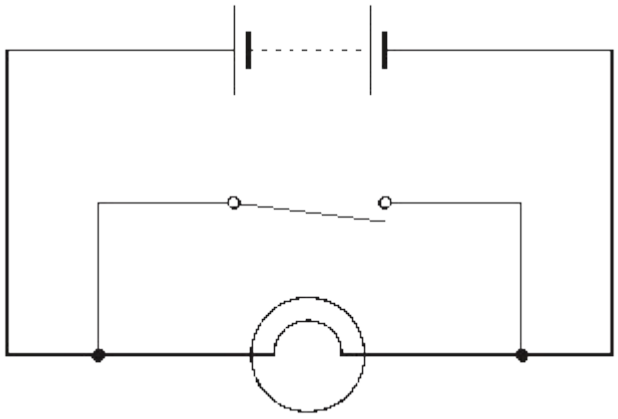
_____

(2)

(Total 6 marks)

Q4.

The circuit diagram below shows a battery connected to a lamp and a switch.



(a) State what happens to the lamp when:

(i) the switch is open (OFF);

_____

(ii) the switch is closed (ON).

_____

(2)

(b) When the switch is closed what problem is caused in the circuit?

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_____

_____

_____

(1)

(c) In the space below draw a circuit diagram to show how the switch should be correctly connected to the lamp and battery.

(1)

(Total 4 marks)

Q5.

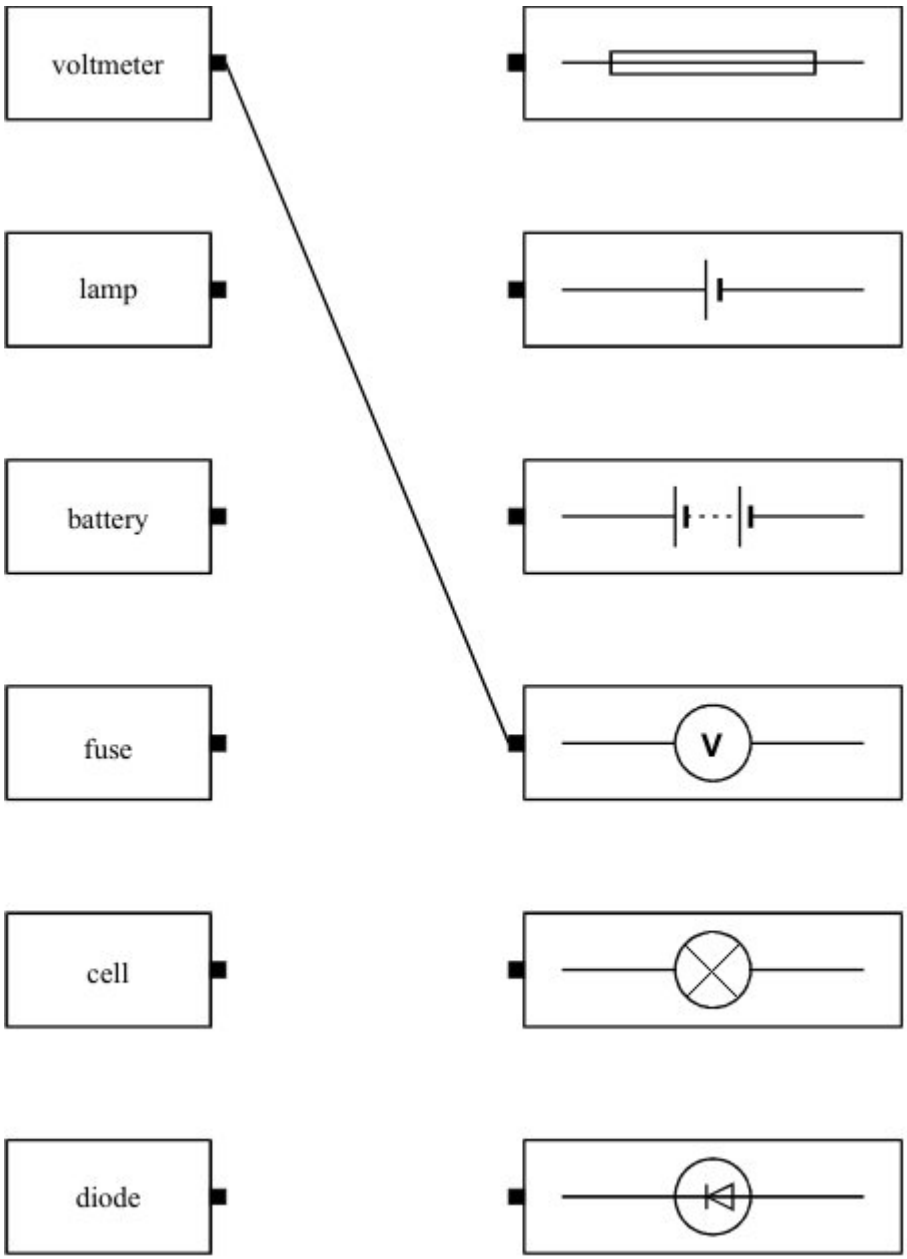
(a) Complete the sentence below to name the instrument used to measure electrical current.

The instrument used to measure electrical current is called _____

(1)

(b) In the diagram below each box contains an electrical component or a circuit symbol. Draw straight lines to link each electrical component to its circuit symbol. The first one has been done for you.

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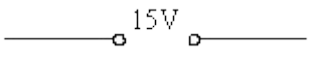
(4)

(Total 5 marks)

Q6.

A student investigates how the current flowing through a filament lamp changes with the voltage across it.
She is given a filament lamp and connecting wires.
She decides to use a 15V power supply, a variable resistor, an ammeter, a voltmeter and a switch.

(a) Complete the circuit diagram to show how she should set up the circuit.



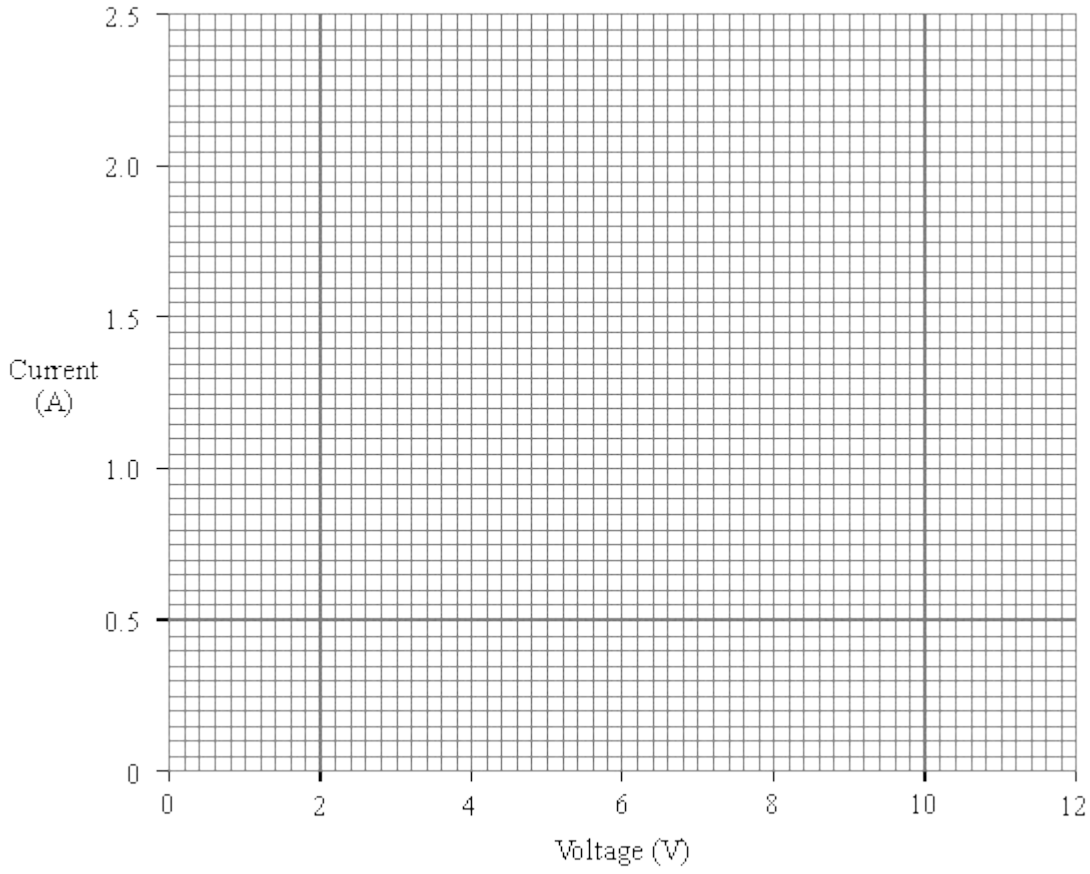
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(4)

(b) The student obtains the following results.

VOLTAGE (V)	0.0	3.0	5.0	7.0	9.0	11.0
CURRENT (A)	0.0	1.0	1.4	1.7	1.9	2.1

(i) Plot a graph of current against voltage.



(3)

(ii) Use your graph to find the current when the voltage is 10V.

Current _____ A

(1)

(iii) Use your answer to (ii) to calculate the resistance of the lamp when the voltage is 10V.

_____

_____

_____

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Resistance _____ Ω

(2)

(c) (i) What happens to the resistance of the lamp as the current through it increases?

_____

(ii) Explain your answer.

_____

_____

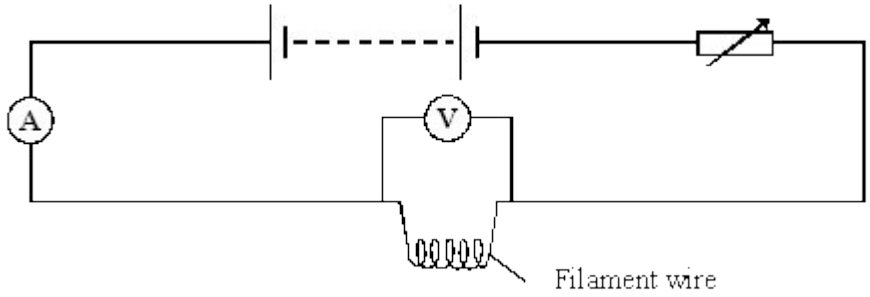
_____

(2)

(Total 12 marks)

Q7.

A bulb heats up when an electric current passes through the filament wire. The current was measured when different voltages were applied across the filament wire shown in the diagram below.



(a) (i) Look at the circuit diagram. How was the voltage changed?

_____

_____

(1)

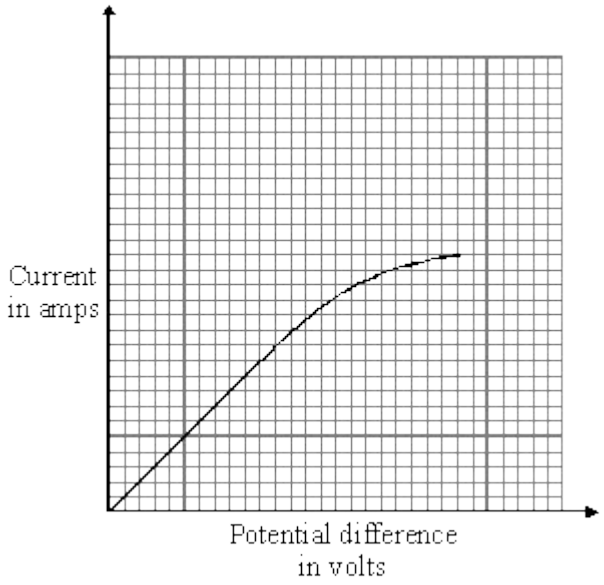
(ii) Write an equation that shows the relationship between *current, potential difference* and *resistance.*

_____

(1)

(b) The graph shows how the current through the filament wire changed as the potential difference across it changed.

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(i) Describe the effect of increasing the potential difference on the current flowing through the filament wire.

_____

_____

_____

(2)

(ii) Explain this effect in terms of the resistance of the filament wire.

_____

_____

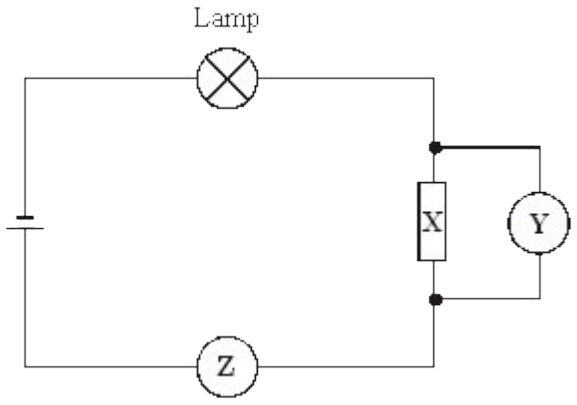
_____

(2)

(Total 6 marks)

Q8.

The diagram shows a circuit.



(a) (i) Name component **X**. _____

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(ii) What does meter **Y** measure? _____

(iii) What does meter **Z** measure? _____

(3)

(b) Which of the equations shows how current, potential difference and resistance are related?

Tick the box against the correct equation.

current = potential difference × resistance ☐

potential difference = current × resistance ☐

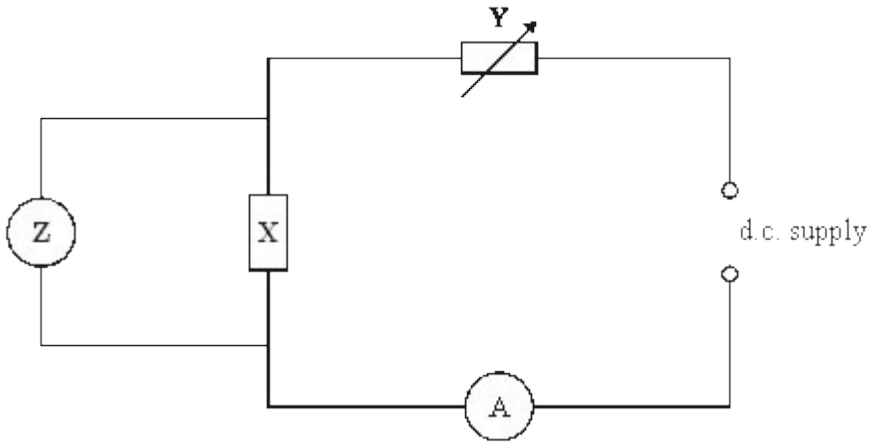
resistance = current × potential difference ☐

(1)

(Total 4 marks)

Q9.

The current through component **X** is measured when different voltages are applied across it.



(a) Name the component labelled **Y** in the circuit.

_____

(1)

(b) What type of meter is **Z**?

_____

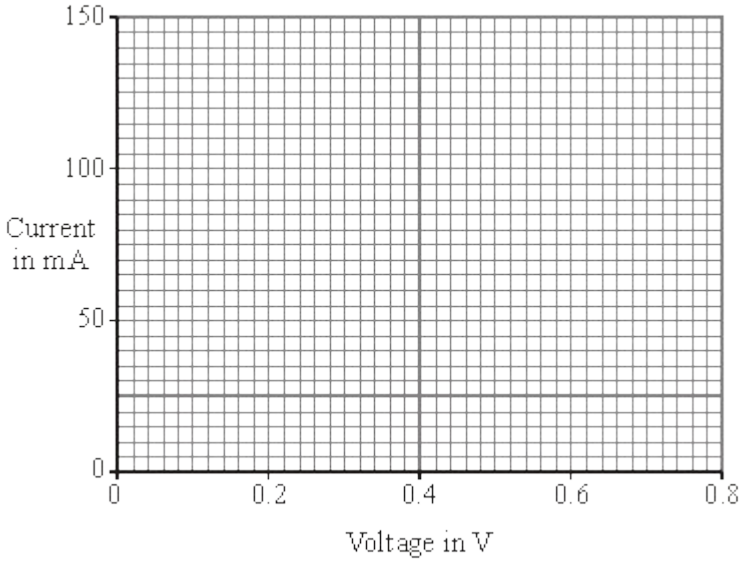
(1)

(c) The table shows the measurements obtained in this experiment.

Voltage in V	0	0.2	0.4	0.6	0.8
Current in mA	0	0	50	100	150

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Draw a graph of the measurements.



(2)

(d) Use the shape of the graph to name component **X**.

_____

(1)

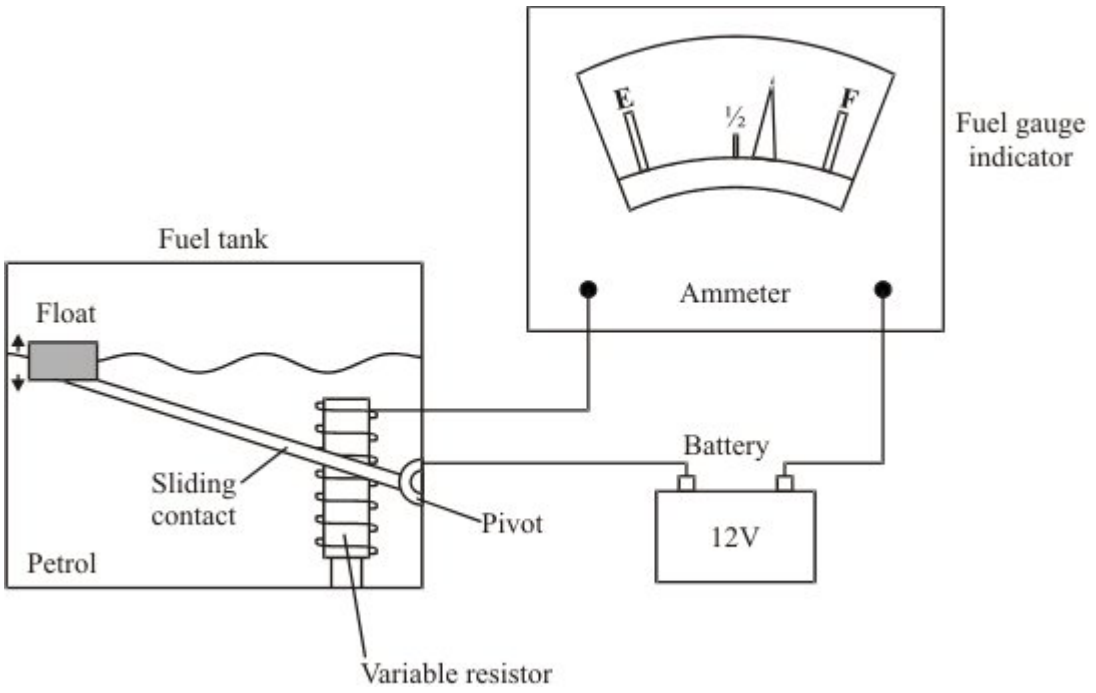
(Total 5 marks)

Q10.

The diagram shows the fuel gauge assembly in a car.

- The sliding contact touches a coil of wire and moves over it.
- The sliding contact and the coil form a variable resistor.
- The sliding contact is connected to a float via a pivot.
- The fuel gauge indicator is an ammeter.
- When the petrol level changes, the resistance of the circuit changes.
- This causes the pointer in the fuel gauge indicator to move.

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(a) Use standard symbols to draw a circuit diagram for the fuel gauge assembly.

(3)

(b) How will the current in the circuit change as the level of petrol in the tank falls?

_____

Explain the reason for your answer.

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_____

_____

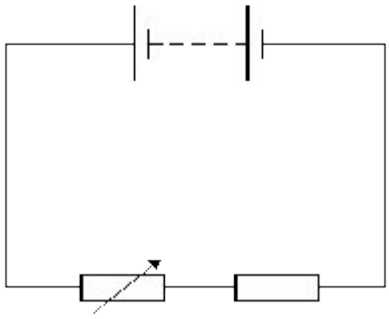
_____

(2)

(Total 5 marks)

Q11.

(a) The diagram shows a simple circuit. Add an ammeter and a voltmeter to the circuit to show how to measure the current through the fixed resistor and the voltage across it.



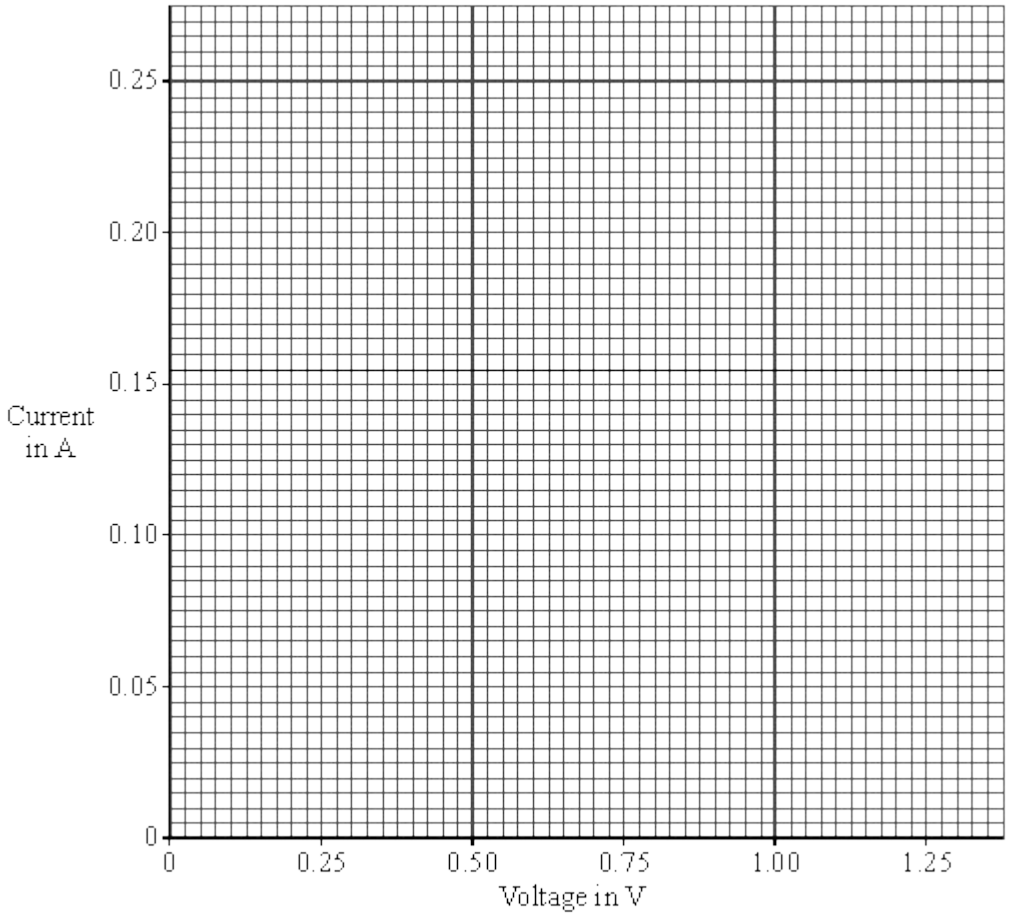
(2)

(b) An experiment using a circuit like the one above was set up. The following results were obtained when the resistance of the variable resistor was decreased.

(i) Draw a graph of the results below.

Voltage across fixed resistor in volts	Current in amps
0.50	0.10
0.75	0.15
1.00	0.20
1.25	0.25

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(2)

(ii) Use the graph to find the voltage when the current is 0.05 A.

Voltage =_____ V

(1)

(Total 5 marks)

Q12.

The following specification is taken from the instruction booklet of a combination microwave oven.

AC voltage	240 V 50 Hz
Power required	
Microwave	1.5 kW
Dual (Roast/Bake)	2.8 kW
Dual (Grill)	2.5 kW
Convection	1.35 kW
Grill	2.3 kW
Output power	

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Microwave	850 W
Convection heater	1350 W
Grill heater	1000 W
Microwave frequency	2450 MHz

(a) (i) What is the current when the oven is being used to cook in the dual (roast/bake) mode? Show clearly how you work out your answer.

_____

_____

Current = _____ A

(2)

(ii) Calculate the resistance of this combination microwave oven when it is being used in the dual (roast/bake) mode. Show clearly how you work out your answer and give the units.

_____

_____

_____

Resistance = _____

(3)

(b) What is the percentage efficiency of the oven when it is working in the microwave mode?

_____

_____

_____

Percentage efficiency = _____ %

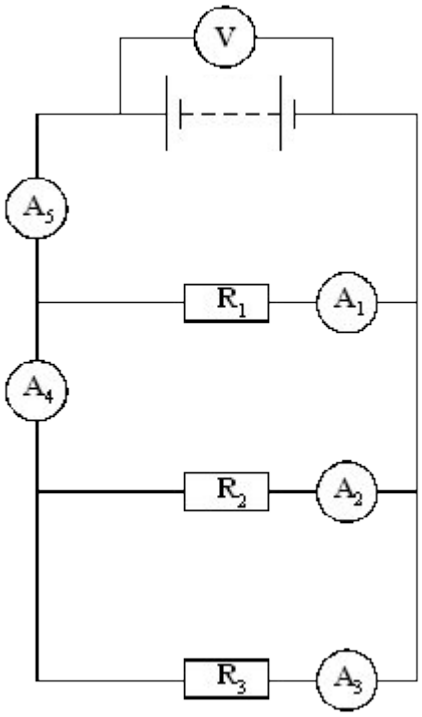
(2)

(Total 7 marks)

Q13.

A circuit was set up as shown in the diagram.

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(a) The table gives the current through three of the ammeters. Complete the table to show the current through the other two ammeters.

Ammeter	Reading on ammeter in amps
A_1	0.2
A_2	0.6
A_3	0.3
A_4	
A_5	

(2)

(b) The reading on the voltmeter is 12 V.

What is the resistance of $\mathbf{R_2}$?

Show your working and include the correct unit.

_____

_____

_____

Resistance = _____

(3)

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(c) In the circuit above, the resistor R_2 burned out and current stopped flowing in it. There was no other change to the circuit.

Complete the table below to show the readings on the ammeters after this took place.

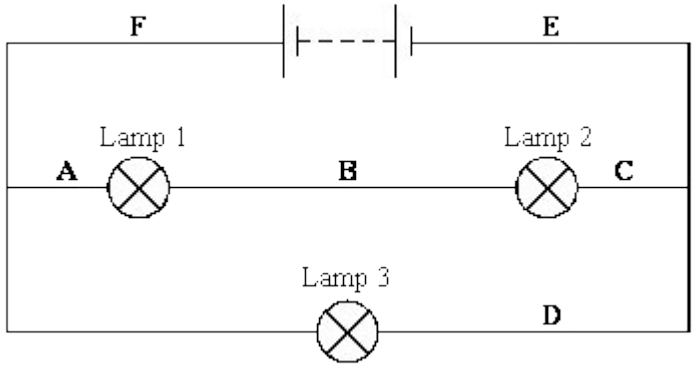
Ammeter	Reading on ammeter in amps
A_1	0.2
A_2	0.0
A_3	
A_4	
A_5	

(3)

(Total 8 marks)

Q14.

The circuit contains three identical lamps.



(a) Complete each of the sentences about the circuit, using one of the phrases in the box.

more than	less than	the same as

(i) The current at **A** is _____ the current at **B**.

(1)

(ii) The current at **A** is _____ the current at **D**.

(1)

(iii) The current at **F** is _____ the current at **E**.

(1)

(iv) The current at **F** is _____ the current at **D**.

(1)

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(b) In the circuit, which lamp is brightest? _____

Give a reason for your answer.

_____

_____

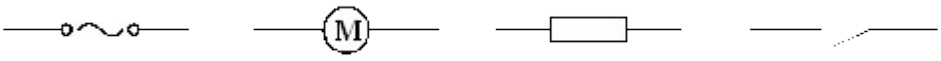
(2)

(Total 6 marks)

Q15.

In a hairdryer circuit there is a heater and a motor. It is important that the motor is always running when the heater is switched on.

(a) Using the symbols shown below only **once** each, draw a circuit for a hairdryer.



(2)

(b) Modern hairdryers are described as *double insulated.*

Explain what this term means.

_____

_____

_____

(2)

(c) On a modern hairdryer handle it states:

1600 W 230 V 50 Hz

(i) [A] Write an equation which shows the relationship between current, power and voltage.

_____

(1)

[B] Calculate the current in the hairdryer when it is on full power.
Show clearly how you get your answer.

_____

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_____

Current = _____ A

(2)

(ii) [A] Write an equation which shows the relationship between current, resistance and voltage.

_____

(1)

[B] The resistance of the heater is 20 ohms. Calculate the resistance of the motor.

Show clearly how you get your answer.

_____

_____

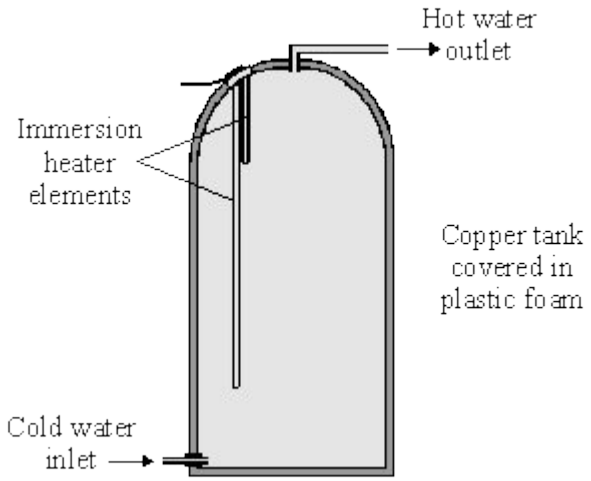
Resistance = _____ ohms

(2)

(Total 10 marks)

Q16.

The diagram shows a type of electric immersion heater in a hot water tank. These hot water tanks are normally found in airing cupboards.



Information on the immersion heater states:

230 V
10 A

(a) (i) What is the equation which shows the relationship between power, current and voltage?

_____

(1)

(ii) Calculate the power of the heater. Show clearly how you get to your answer and give the units.

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_____

Power = _____

(2)

(b) (i) What rating of fuse should be in the immersion heater circuit?

_____

(1)

(ii) There are three wires in the cable to the immersion heater. Two of the wires are connected to the immersion heater. The third wire is connected to the copper tank.

Explain the function of this third wire and the fuse in the circuit.

_____

_____

_____

_____

(3)

(c) (i) What is the equation which shows the relationship between resistance, current and voltage?

_____

(1)

(ii) Calculate the resistance of the heater. Show clearly how you get to your answer and give the units.

_____

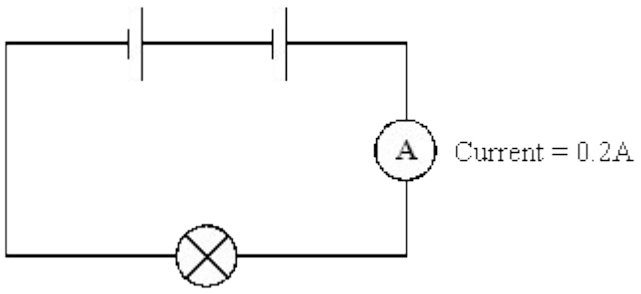
Resistance = _____

(2)

(Total 10 marks)

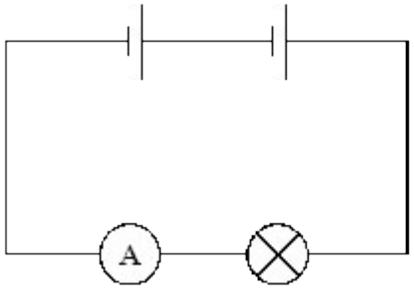
Q17.

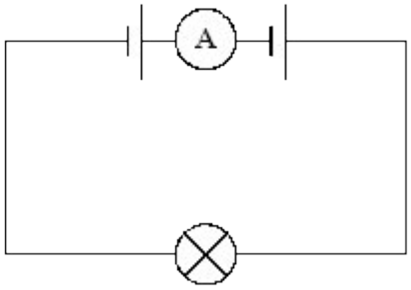
The circuit contains two cells, an ammeter and a lamp. The reading on the ammeter is 0.2 A.



(a) What will be the reading on the ammeters in each of the circuits below?

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(i) Current is _____ A

(ii) Current is _____ A

(2)

(b) An ammeter was in a series circuit with two cells and a variable resistor.

The ammeter showed a reading of 0.3 A.

(i) Draw a circuit diagram for the circuit.

(2)

(ii) What will happen to the reading on the ammeter if the resistance of the variable resistor is **increased**?

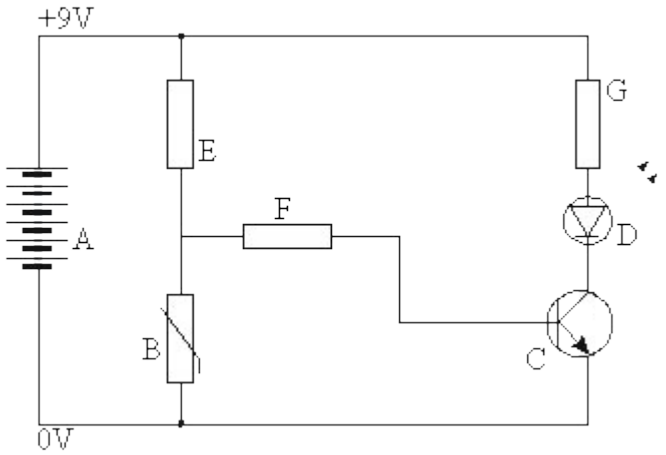
_____

(1)

(Total 5 marks)

Q18.

The diagram shows an electronic circuit.



(a) Write down the names of the components in the list below.

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A = _____

B = _____

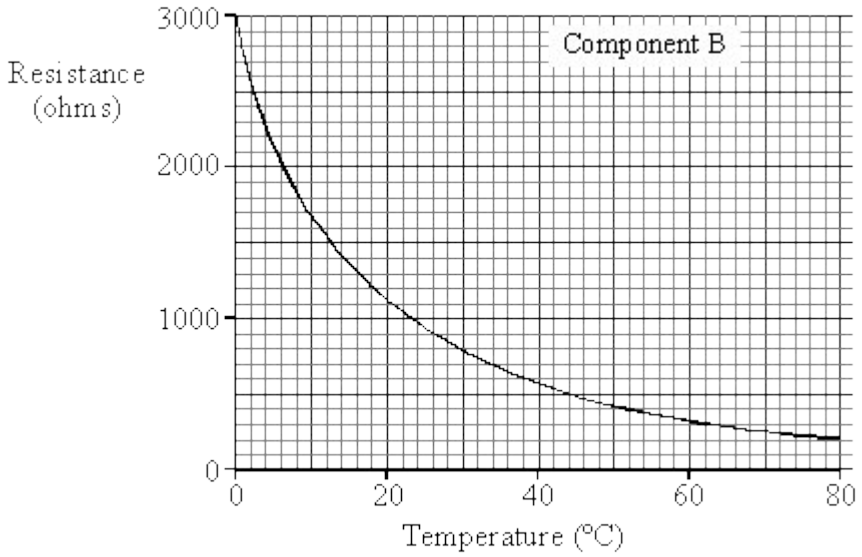
C = _____

D = _____

E, F and G = _____

(5)

(b) The graph shows how the resistance of component B depends on its temperature.



Describe, in as much detail as you can, how the resistance of component B changes as its temperature rises from 0ºC to 80ºC.

_____

_____

_____

_____

_____

(4)

(c) At what temperature does component B have a resistance of 1000 ohms?

Answer _____ °C .

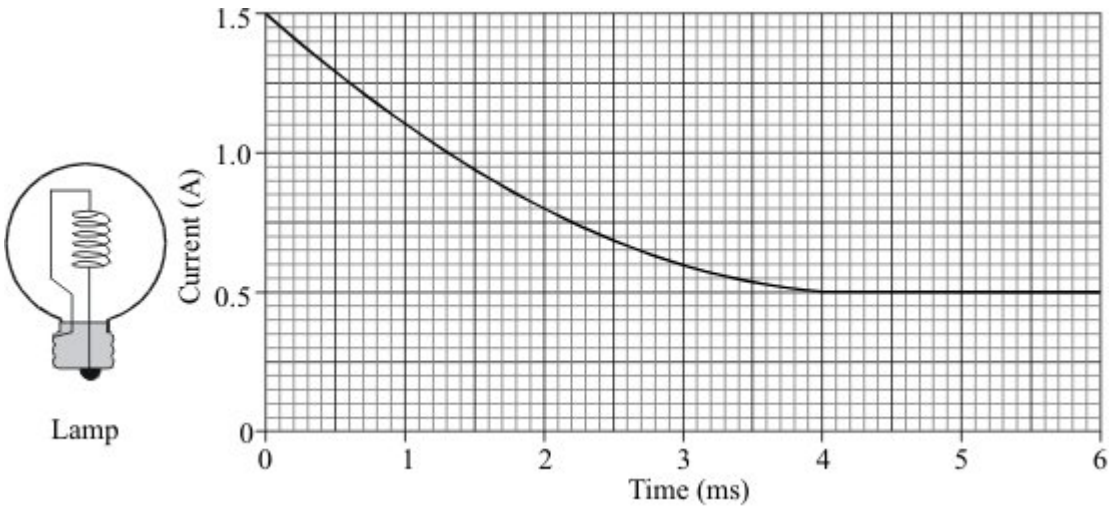
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(Total 11 marks)

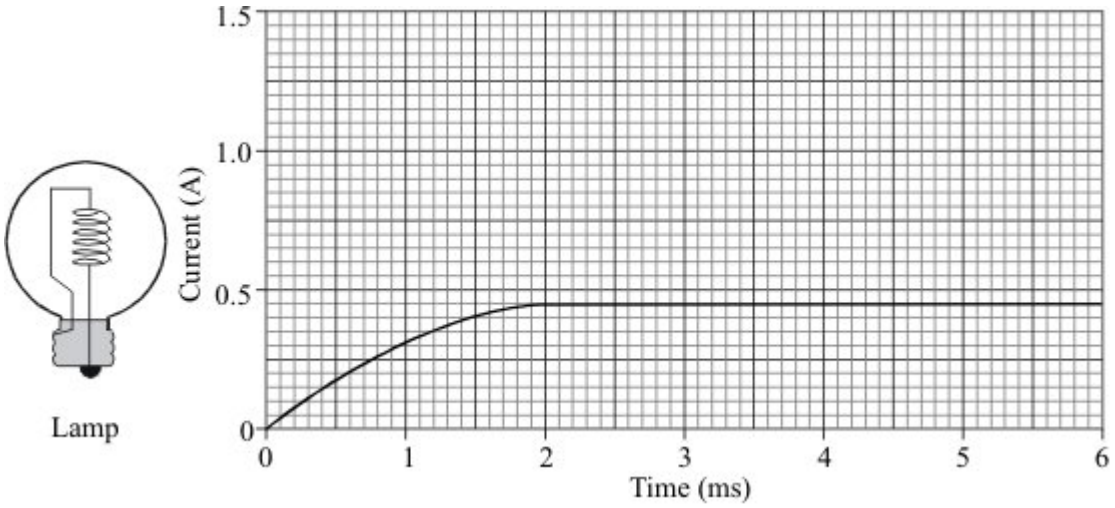
Q19.

A computer is set up to produce a graph of the current through an electric lamp during the first few milliseconds after it is switched on.

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The lamp is modified then tested in the same way.



(a) Describe **three** differences in the way the lamp behaves after it has been modified.

1. _____

2. _____

3. _____

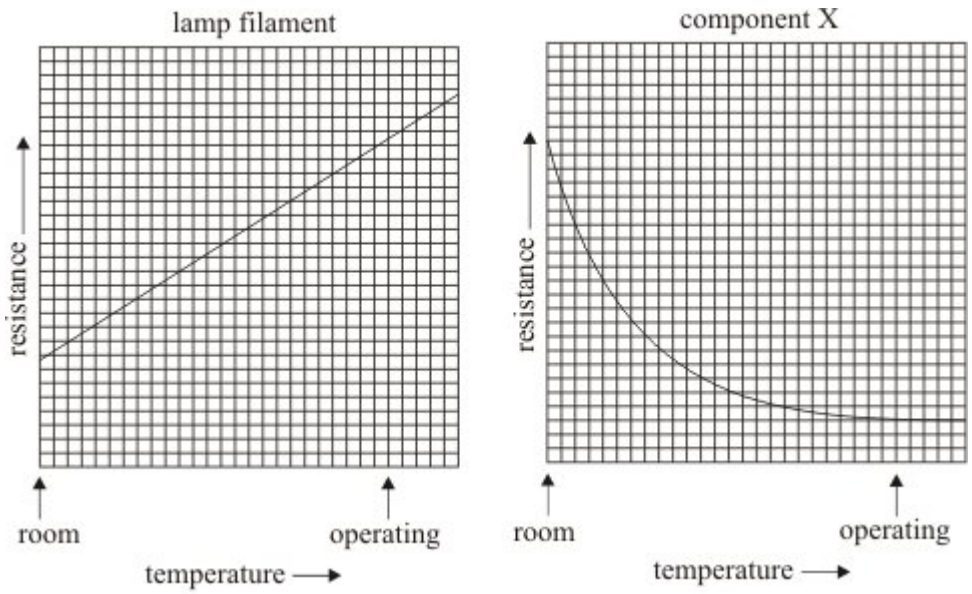
(3)

(b) The current through the modified lamp depends on the total resistance of the filament and component X.

The smaller this total resistance is, the greater the current.

The following graphs show how the resistance of the lamp filament and component X change as the lamp heats up to its operating temperature.

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Use the information shown on the graphs to explain the behaviour of the modified lamp.

_____

_____

_____

_____

_____

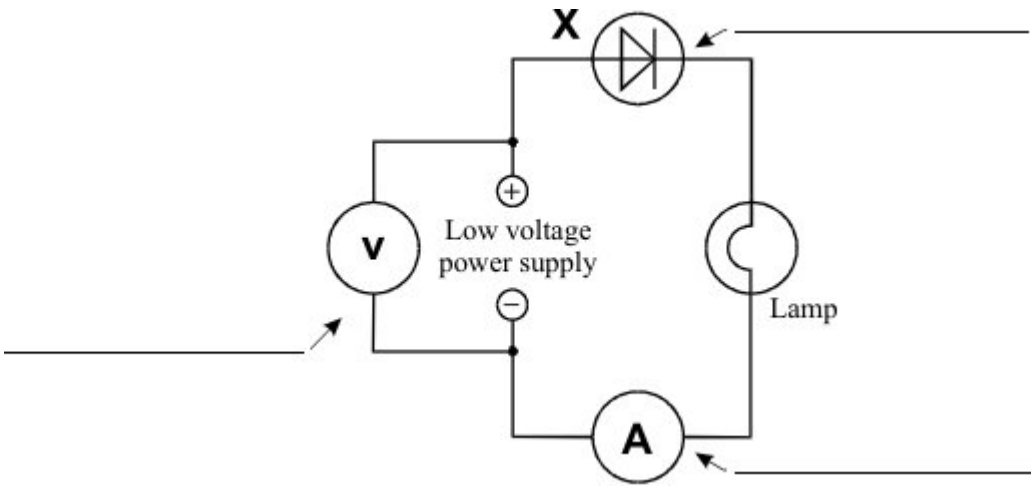
_____

(4)

(Total 7 marks)

Q20.

(a) Add the missing labels to the diagram.



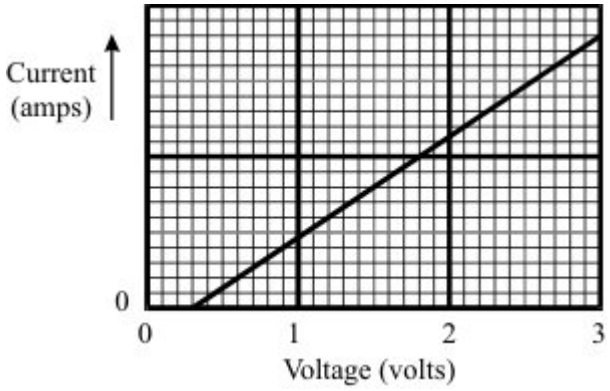
(3)

(b) Some students use the circuit shown above.

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They want to find out how the current through component X changes as they change the voltage.

The graph shows their results.



Describe, as fully as you can, what happens to the current through component X as the students increase the voltage.

_____

_____

_____

_____

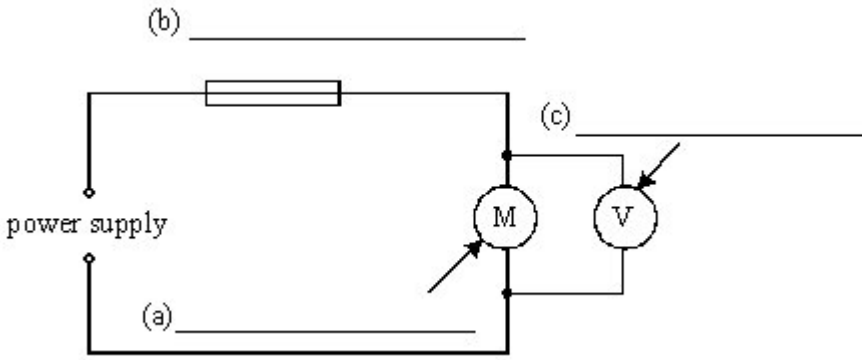
_____

(4)

(Total 7 marks)

Q21.

Label the parts of the electric circuit below.



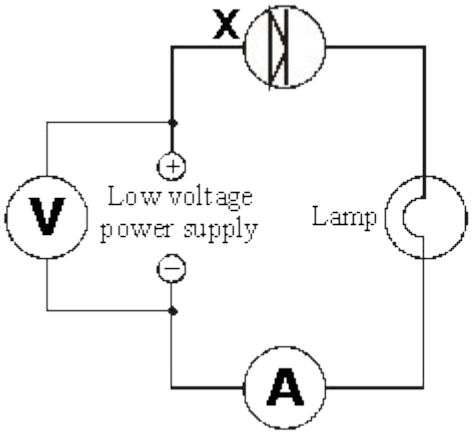
(Total 3 marks)

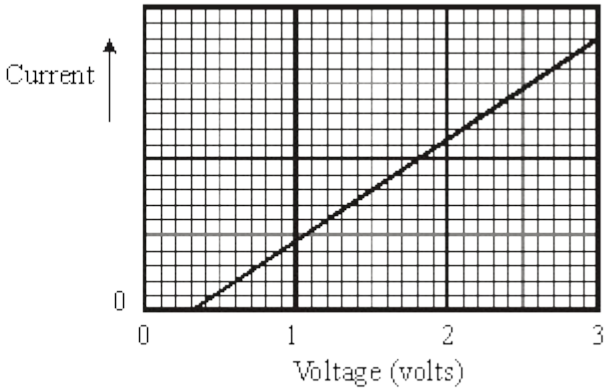
Q22.

Some students want to find out how the current through component X changes with the voltage they use.

The diagram shows their circuit. The graph shows their results.

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(a) Describe, as fully as you can, what happens to the current through component X as the students increase the voltage.

_____

_____

_____

(4)

(b) The students want to find out whether component X allows the same current to flow through it in the opposite direction.

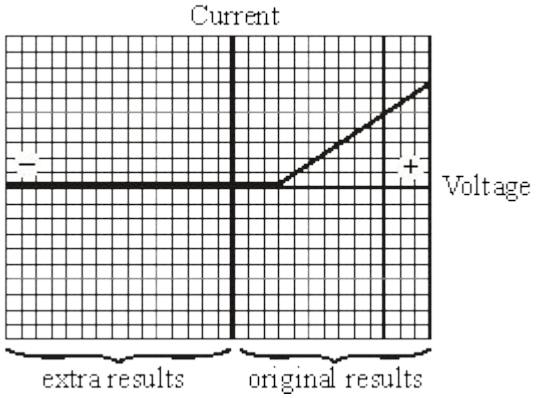
(i) How should they change the circuit to test this?

_____

(1)

(ii) The graph shows the students' extra results.

What do the extra results tell you?



_____

_____

_____

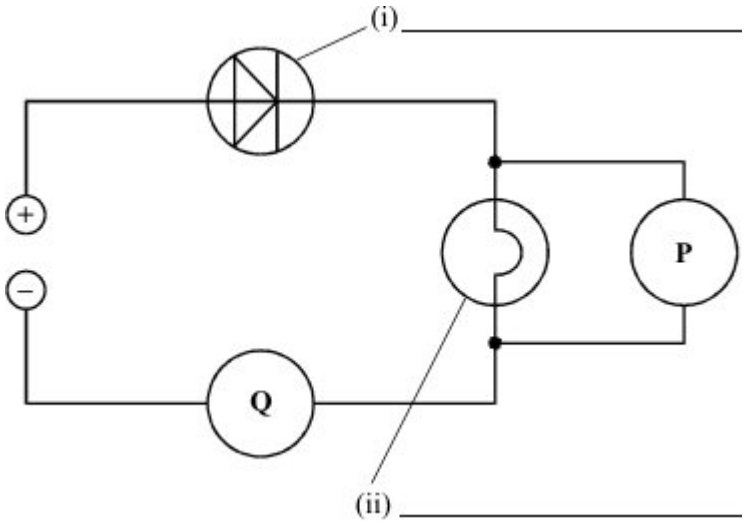
(1)

(Total 6 marks)

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Q23.

The diagram shows an electrical circuit.



(a) Complete the two labels on the diagram.

(2)

(b) **P** and **Q** are meters.

What is meter **P** measuring? _____

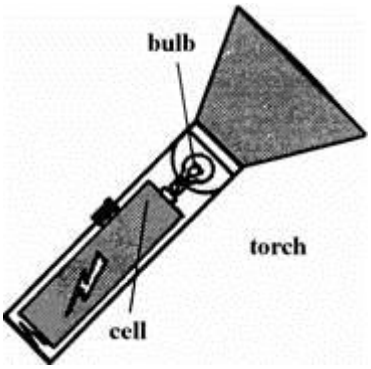
What is meter **Q** measuring? _____

(2)

(Total 4 marks)

Q24.

A small torch uses a single cell to make the bulb light up.



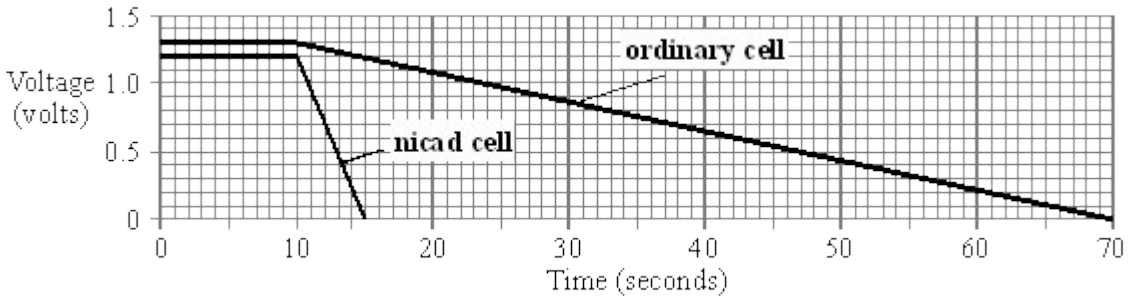
(a) Label the symbol for a cell and the symbol for a bulb (lamp)



(2)

(b) The graphs show the voltage across two different types of cell as they transfer the last bit of their stored energy through the torch bulb.

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Describe the differences that the graphs show between the two types of cell.

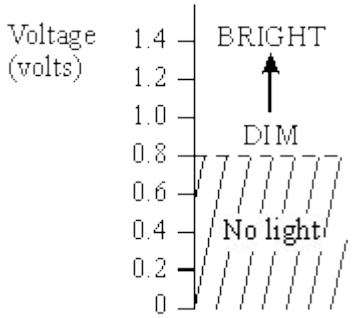
_____

_____

_____

(3)

(c) The diagram shows how bright the torch bulb is for different voltages.



From the point when the voltage of each cell starts to fall, how long will the bulb stay lit:

(i) with the ordinary cell?

_____

(ii) with the nicad cell?

_____

(4)

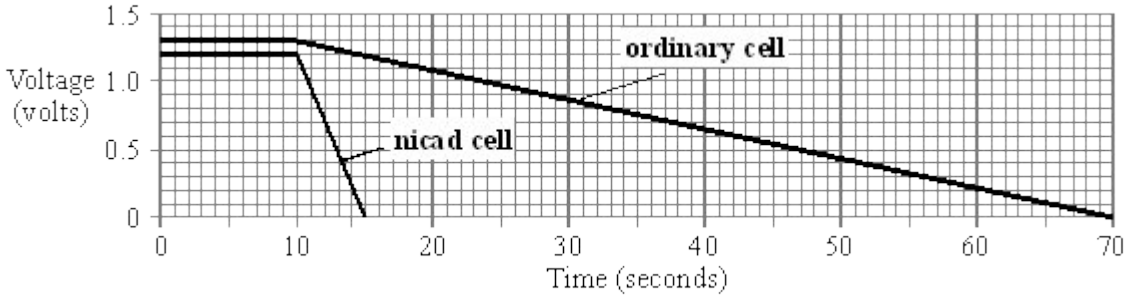
(Total 9 marks)

Q25.

A small torch uses a single cell to make the bulb light up.

(a) The graphs show the voltage across two different types of cell as they transfer the last bit of their stored energy through the torch bulb.

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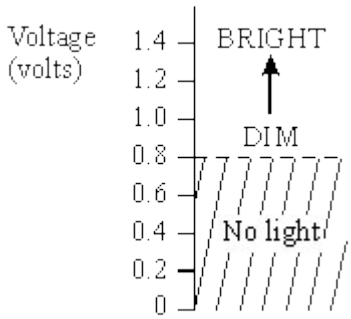
Describe the differences that the graphs show between the two types of cell.

_____

_____

(3)

(b) The diagram shows how bright the torch bulb is for different voltages.



From the point when the voltage of each cell starts to fall, how long will the bulb stay lit:

(i) with the ordinary cell?

_____

(ii) with the nicad cell?

_____

(4)

(c) When the voltage across the bulb falls to half, the current through the bulb falls by **less than** half. Why is this?

_____

_____

_____

_____

(3)

(Total 10 marks)

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